

Board of Education Agenda Item

Item: E.

Date: June 28, 2007

Topic: Final Review of Proposed Standards of Learning for Algebra, Functions, and Data Analysis

Presenter: Mr. James C. Firebaugh, Director, Office of Middle and High School Instruction

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Origin:

☐ Topic presented for information only (no board action required)

☒ Board review required by

☒ State or federal law or regulation

☐ Board of Education regulation

☐ Other: _____

☒ Action requested at this meeting ☐ Action requested at future meeting: ☐

Previous Review/Action:

☐ No previous board review/action

☒ Previous review/action

Date February 28, 2007

Action Approved for first review and public comment

Background Information:

In October 2006, the Board approved a plan to develop a set of *Standards of Learning* (SOL) for a new optional, high school mathematics course. In February 2007, the Board approved the draft SOL for public comment and public hearings. Three public hearings were held: one on April 27, 2007, in Richmond; and two on April 30, 2007, in Fairfax County and Wythe County. No comments were received at the public hearings in Richmond or Wythe County. Comments were received at the public hearing in Fairfax County. Written comments were also received during the comment period. All comments submitted during the public comment period were reviewed and analyzed. Several recommendations have been incorporated into the proposed document presented to the Board for final review. The revisions were made to enhance clarity, specificity, rigor, and alignment of skills and content, and to reflect the most current best practices.

Summary of Major Elements:

The proposed revised *Algebra, Functions, and Data Analysis Standards of Learning* (Attachment A) is attached. Final revisions were made based on the public comments received by e-mail, at public hearings, and written communication. Specific comments are summarized in Attachment B. Comments were received at only one public hearing.

Summary of the written and oral comments received:

- Request to include piece-wise functions, logarithmic function, and power functions in the list of functions to be studied
- Request that specific applications and technology use be included in the SOL
- Request to include Law of Large Numbers in probability
- Request to increase emphasis on communication of outcomes and/or analyses in Data Analysis
- Request to change “extrapolate” to “interpolate” in AFDA.3
- Request to further clarify methods of finding the equation of the best fit line

Revisions made as a result of comments received:

- Include the requested logarithmic function
- Include the requested Law of Large Numbers
- Replace “extrapolate” with “interpolate” in AFDA.3

The other comments are more appropriately addressed in a Curriculum Framework for the proposed *Algebra, Functions, and Data Analysis Standards of Learning*.

Several persons commenting also had questions involving the implementation of *Algebra, Functions, and Data Analysis* in course sequences leading to Standard or Advanced Studies Diplomas.

- How will the proposed course support course sequences leading to a Standard Diploma?
- How will the proposed course support course sequences leading to an Advanced Studies Diploma?
- If the course is above the level of Algebra I, will it be below the level of Algebra II?
- Will there be an end-of-course assessment for the proposed course?

The Board of Education approves the courses to satisfy graduation requirements for the Standard, Advanced Studies, and Modified Standard Diplomas in Virginia public schools. The list was last revised in June 2002. Currently Algebra I, Parts I and II, may be used to satisfy two units of mathematics credit. Geometry, Parts I and II, may also be used to satisfy two units of mathematics credit. For the Advanced Studies Diploma, only one unit of credit for a Part I course may be used to satisfy the four required mathematics credits for graduation. A second unit may be granted as an elective credit.

As proposed, the *Algebra, Functions, and Data Analysis* course includes content above the level of algebra and geometry but less comprehensive than Algebra II. The course would be added to the Board’s list of approved courses for mathematics graduation credit.

As the Board continues the process to review the *Regulations Establishing Standards for Accrediting Public Schools in Virginia*, it may want to consider removing the option that Algebra I, Part I, may count as a mathematics credit for graduation for either the Standard or Advanced Studies Diploma. In other words, completion of Algebra I, Parts I and II, could be used for one mathematics credit and one elective credit. In such a case, the newly proposed course, *Algebra, Functions, and Data Analysis*, if approved as an addition to the list of approved courses, could serve as an additional option for completion of the mathematics requirements for a Virginia diploma.

At this time, there are no plans to develop an end-of-course assessment for *Algebra, Functions, and Data Analysis*. Students would still need to earn the required verified credits in Algebra I, Geometry, or Algebra II.

Superintendent's Recommendation:

The Superintendent of Public Instruction recommends that the Board of Education adopt the proposed *Algebra, Functions, and Data Analysis Standards of Learning*, and authorize the Department of Education to include the course on the Board's list of approved courses above the level of algebra and geometry to satisfy a standard credit towards the mathematics graduation requirements for the Standard, Advanced Studies, and Modified Standard Diplomas.

Impact on Resources: The resources needed to develop the curriculum framework for this course may be absorbed by the Department's existing resources at this time. School divisions implementing the proposed course would need to provide textbooks and other instructional materials for students.

Timetable for Further Review/Action: The *Standards of Learning* Development Work Plan calls for the adoption of the *Standards of Learning* in late spring 2007 to be followed by the development of a curriculum framework in 2007.

**Proposed *Standards of Learning* for
Algebra, Functions, and Data Analysis
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The following standards outline the content for a one-year course in Algebra, Functions, and Data Analysis. This course is designed for students who have successfully completed the standards for Algebra I. Within the context of mathematical modeling and data analysis, students will study functions and their behaviors, systems of inequalities, probability, experimental design and implementation, and analysis of data. Data will be generated by practical applications arising from science, business, and finance. Students will solve problems that require the formulation of linear, quadratic, ~~or~~ exponential, or logarithmic equations or a system of equations.

Through the investigation of mathematical models and interpretation/analysis of data from real life situations, students will strengthen conceptual understandings in mathematics and further develop connections between algebra and statistics. Students should use the language and symbols of mathematics in representations and communication throughout the course.

These standards include a transformational approach to graphing functions and writing equations when given the graph of the equation. Transformational graphing builds a strong connection between algebraic and graphic representations of functions.

The infusion of technology (graphing calculator and/or computer software) in this course will assist in modeling and investigating functions and data analysis.

Algebra, Functions, and Data Analysis

Algebra and Functions

- AFDA.1 The student will investigate and analyze function (linear, quadratic, ~~and~~ exponential, and logarithmic) families and their characteristics. Key concepts include:
- a) continuity
 - b) local and absolute maxima and minima
 - c) domain and range
 - d) zeros
 - e) intercepts
 - f) intervals in which the function is increasing/decreasing
 - g) end behaviors
 - h) asymptotes
- AFDA.2 The student will use knowledge of transformations to write an equation given the graph of a function (linear, quadratic, ~~and~~ exponential, and logarithmic).
- AFDA.3 The student will collect data and generate an equation for the curve (linear, quadratic, ~~and~~ exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to ~~extrapolate~~ interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

- AFDA.4 The student will transfer between and analyze multiple representations of functions including algebraic formulae, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction.
- AFDA.5 The student will determine optimal values in problem situations by identifying constraints and using linear programming techniques.

Data Analysis

- AFDA.6 The student will calculate probabilities. Key concepts include:
- a) conditional probability
 - b) dependent and independent events
 - c) addition and multiplication rules
 - d) counting techniques (permutations and combinations)
 - e) Law of Large Numbers
- AFDA.7 The student will analyze the normal distribution. Key concepts include:
- a) characteristics of normally distributed data
 - b) percentiles
 - c) normalizing data using z-scores
 - d) area under the standard normal curve and probability
- AFDA.8 The student will design and conduct an experiment/survey. Key concepts include:
- a) sample size
 - b) sampling technique
 - c) controlling sources of bias and experimental error
 - d) data collection
 - e) data analysis and reporting

Algebra, Functions, and Data Analysis Standards of Learning:
Summary of Comments Received at Public Hearings and Written Comments Received
June 28, 2007

Number	Name	Role	Comments
Richmond City Public Hearing 4/27/2007	No public comment was received.		
Fairfax County Public Hearing 4/30/2007	Marla Schnall	Parent	--Idea of a class after Algebra I and Geometry is a wonderful idea (for when Algebra II is too difficult); however, the way the course is laid out it won't really address the issue of the content being too challenging for those students. --The content seems very similar to Algebra II and if there is no test, then I worry that schools will create their own curriculum and the course will not be rigorous, if that is the intent. --Is there material to back up the content of course and, if not, it will be a "dumbed down" Algebra II if there is no SOL test. --Include opportunities to use technology to make it more real, analyzing data. --There could be issues with access to technology for some students.
	Craig Herring	High School Mathematics Specialist, Fairfax County Public Schools	--Reviewed the SOL for the new course with 27 mathematics department chairs in Fairfax County Questions: --Will the course be a terminating class? --Are students expected to go on to Algebra II after this course? There seems to be some overlap of content. --Will there be an end-of-course SOL test? --The SOL lack applications and infusion of technology. --Will the name of the course change? --The curriculum looks a lot like Algebra II and Probability and Statistics without a lot of continuity. --How will this course fit into an Advanced Studies Diploma?
	Sheila Sobeski	Student, parent	--Was poll taken on test scores as well in wanting to implement this course? --Do you have a system in place that you could measure its (the course's) success?

Algebra, Functions, and Data Analysis Standards of Learning:
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	Ashley Tremper	Educator, Alexandria	<p>Pros:</p> <p>--The course is a good opportunity for conceptual, hands-on learning.</p> <p>--It is an excellent course to link high school to college and to the real-world.</p> <p>Cons:</p> <p>--The course could become a dumping ground for students not eligible for Algebra II.</p> <p>--Who is qualified to teach class?</p> <p>--Will students choose the course as an elective, or is it by teacher recommendation?</p> <p>--Will there be pilot classes to show success and who will determine this?</p>
Wythe County Public Hearing 4/30/2007	No comment was received.		
Written Comments Received Via E-mail	<p>Written comments received from:</p> <ul style="list-style-type: none"> • Jim Batterson, Office of the Secretary of Education, Commonwealth of Virginia • J. Patrick Lintner, Mathematics Supervisor, Harrisonburg City Public Schools • Christine Belcher, Mathematics Coach, Hanover County Public Schools • Andrea Hundley, Teacher, Campbell County Public Schools • Ben Bazak, Mathematics Instructional Chairperson, Roanoke City Public Schools <p>Summary of written comments:</p> <ul style="list-style-type: none"> • Request to include piece-wise functions, logarithmic function, and power functions in the list of functions to be studied. • Request to include Law of Large Numbers in probability. • Request to increase emphasis on communication of outcomes and/or analyses in data analysis. • Request to change “extrapolate” to “interpolate” in AFDA.3. • Request to further clarify methods of finding the equation of the best fit line. • Good opportunity to introduce the algebra behind finance and investing. • Good opportunity for conceptual, hands-on learning. • Excellent course to link high school to college to real world. • Request that specific applications and technology use be included in the SOL. 		